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### (54) Reforming method and apparatus for hydrogen production

(57) An auto-oxidation and internal heating type reforming method and apparatus for hydrogen production are disclosed for use in a process in which a gaseous mixture of a hydrocarbon or an aliphatic alcohol with water vapor is fed (21) into contact with a mass of a reforming catalyst to bring about a reforming reaction of the gaseous mixture to produce hydrogen, wherein a small amount of an oxidizing catalyst is admixed with the re-

forming catalyst in that mass (52); and a small amount of oxygen is admixed with the gaseous mixture, whereby a portion of the hydrocarbon or aliphatic alcohol is exothermally oxidized to generate a quantity of heat required to reform the gaseous mixture of the hydrocarbon or aliphatic alcohol with water vapor.

EP 1 094 030 A3



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## EUROPEAN SEARCH REPORT

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## DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	WO 96 00186 A (JOHNSON MATTHEY PLC ; PIGNON JOHN FREDERICK (GB); EDWARDS NEIL (GB)) 4 January 1996 (1996-01-04) * claim 1; example 4 *	1,2,5	C01B3/38 C01B3/32 C01B3/48 B01J8/04 C01B3/40 C01B3/50 C01B13/02
X	US 5 112 578 A (MURAYAMA KATSUTOSHI ET AL) 12 May 1992 (1992-05-12) * claim 1; figure 1 *	1,3,5	
Y	IDEIM	8,10-12	
A	IDEIM	13	
X	DE 44 23 587 A (DAIMLER BENZ AG) 11 January 1996 (1996-01-11) * claim 1; figures * * column 2, line 8 - line 22 * * column 2, line 53 - line 66 *	1,2,5,9	
X	TAKI M ET AL: "HIGH EFFICIENT AND COMPACT METHANOL REFORMER FOR FUEL CELLS" TOYOTA TECHNICAL REVIEW, TOYOTA, JP, vol. 47, no. 2, November 1997 (1997-11), pages 76-81, XP002926587 ISSN: 0916-7501 * abstract *	1,5	TECHNICAL FIELDS SEARCHED (Int.Cl.7) C01B B01J
X	WO 99 48805 A (CARPENTER IAN WILLIAM ; JOHNSON MATTHEY PLC (GB); HAYES JOHN WILLIA) 30 September 1999 (1999-09-30) * page 4, line 23 - line 26 * * claim 1; example 2 *	1,2,5	
		-/-	
The present search report has been drawn up for all claims			
Place of search THE HAGUE	Date of completion of the search 8 March 2002	Examiner Van der Poel, W	
CATEGORY OF CITED DOCUMENTS			
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## DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation or document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.)
X	PATENT ABSTRACTS OF JAPAN vol. 012, no. 382 (C-535), 12 October 1988 (1988-10-12) & JP 63 129002 A (HITACHI LTD), 1 June 1988 (1988-06-01) * abstract *	1,2	
Y	IDEIM	11	
Y	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 03, 31 March 1997 (1997-03-31) & JP 08 301601 A (ISHIKAWAJIMA HARIMA HEAVY IND CO LTD), 19 November 1996 (1996-11-19) * abstract *	8,10,12	
A	WO 98 08771 A (LITTLE INC A) 5 March 1998 (1998-03-05) * figure 1 *	13	
TECHNICAL FIELDS SEARCHED (Int.Cl.)			
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	8 March 2002	Van der Poel, W	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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ON EUROPEAN PATENT APPLICATION NO.

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The members are as contained in the European Patent Office EPO file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

08-03-2002

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
WO 9600186	A	04-01-1996		AT 174871 T AU 683760 B2 AU 2749295 A CA 2193115 A1 DE 69506869 D1 DE 69506869 T2 DK 766643 T3 EP 0766643 A1 ES 2126292 T3 WO 9600186 A1 JP 10502047 T US 5762658 A	15-01-1999 20-11-1997 19-01-1996 04-01-1996 04-02-1999 02-06-1999 23-08-1999 09-04-1997 16-03-1999 04-01-1996 24-02-1998 09-06-1998
US 5112578	A	12-05-1992		JP 1261201 A AU 613175 B2 AU 3276789 A CA 1328558 A1 DE 3912003 A1 GB 2222096 A, B	18-10-1989 25-07-1991 19-10-1989 19-04-1994 26-10-1989 28-02-1990
DE 4423587	A	11-01-1996	DE	4423587 A1	11-01-1996
WO 9948805	A	30-09-1999	AU EP WO	3042399 A 1068148 A1 9948805 A1	18-10-1999 17-01-2001 30-09-1999
JP 63129002	A	01-06-1988		NONE	
JP 08301601	A	19-11-1996		NONE	
WO 9808771	A	05-03-1998	US AT AU CN DE EP EP ES JP WO US US US US	6126908 A 203490 T 729890 B2 4161097 A 1228749 A 69705844 D1 1118583 A2 0922011 A2 2159146 T3 2000516902 T 9808771 A2 6083425 A 6207122 B1 6123913 A 6254839 B1 2001009653 A1	03-10-2000 15-08-2001 15-02-2001 19-03-1998 15-09-1999 30-08-2001 25-07-2001 16-06-1999 16-09-2001 19-12-2000 05-03-1998 04-07-2000 27-03-2001 26-09-2000 03-07-2001 26-07-2001

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